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(71) Applicant(s)
Autoliv Development AB
(Incorporated in Sweden)
Patent Department Sweden, S-447 83 Vargarda, Sweden

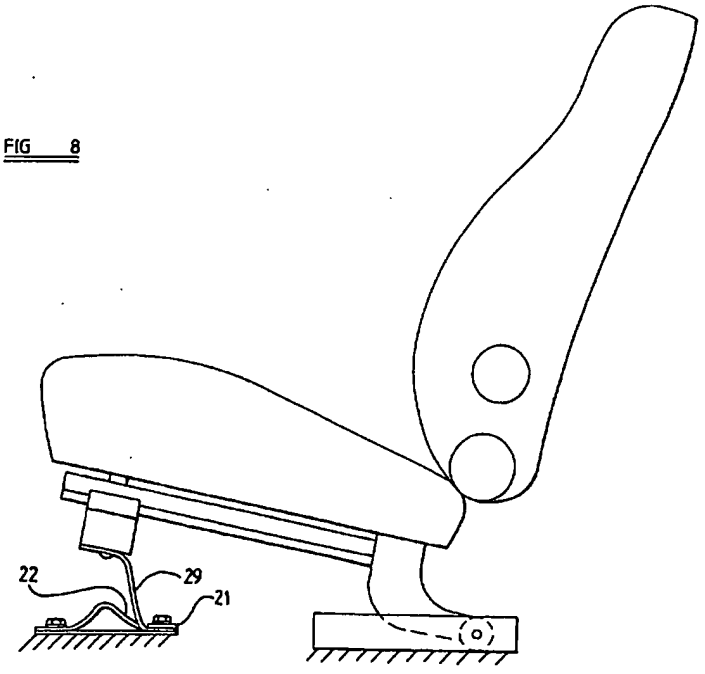
(72) Inventor(s)
Frank Jacobs
Mario Verunac
Harald Zellmer

(74) Agent and/or Address for Service
Forrester Ketley & Co
Forrester House, 52 Bounds Green Road, LONDON, N11 2EY, United Kingdom

(54) Abstract Title
Rearward tipping seat to prevent whiplash in collisions

(57) A seat comprising a squab (1) and a back (2) is intended to be mounted in a motor vehicle. The seat is provided with a roller (4) located at the rear part of the squab which engages a rail (5) mounted on the floor of the motor vehicle. The seat may thus be moved forwardly and rearwardly. The seat may pivot rearwardly about the roller (4) in a rear-impact situation. An element (12) provides a resistive force which resists the rearward tipping action, the element (12) being connected between the floor of the vehicle and a rail (7) provided on the vehicle seat. The level of the resistive force is dependent upon the position of the seat, and thus the resistive force is variable in dependence upon a physical characteristic (height) of the occupant of the seat.

FIG 8



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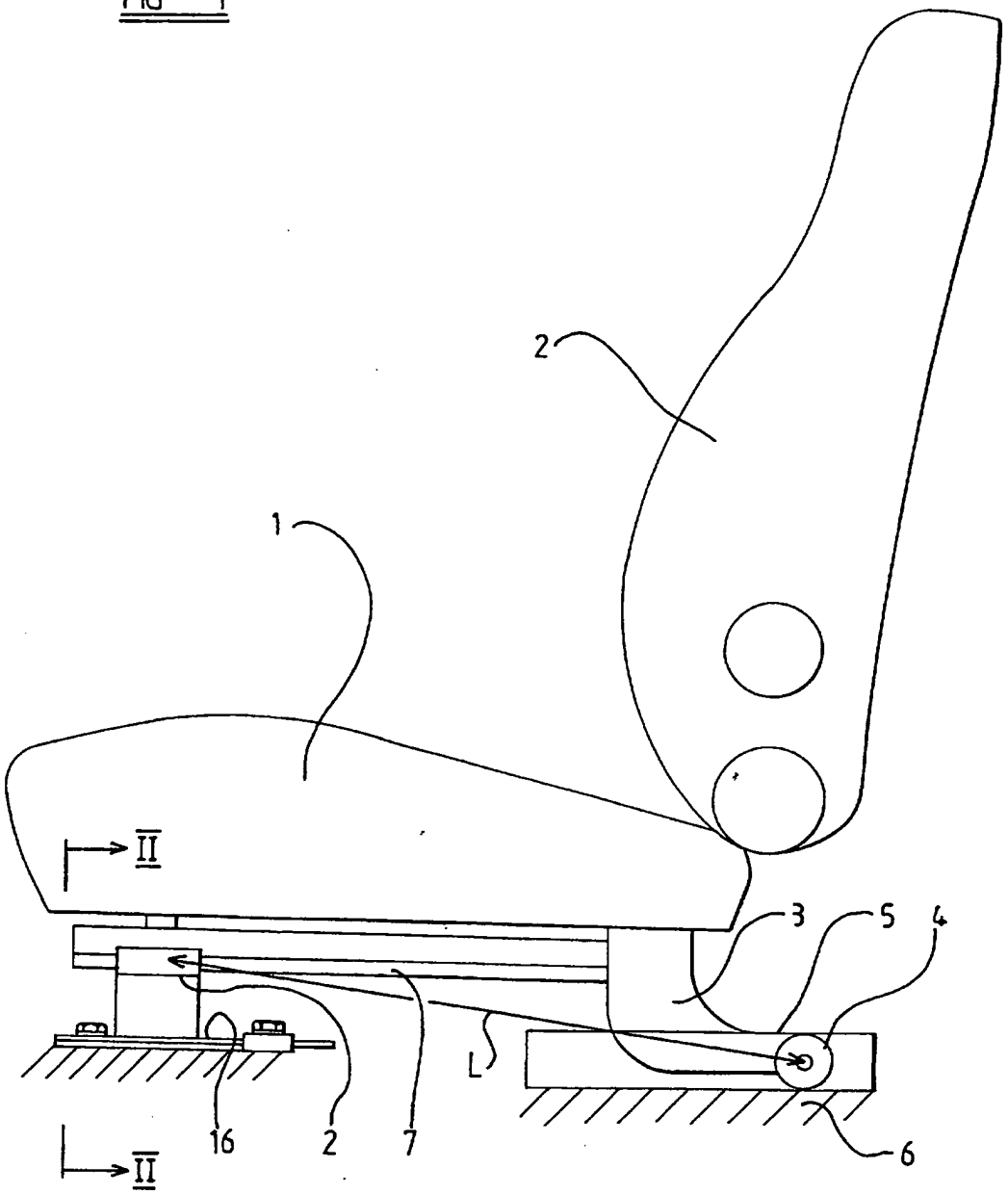
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG 1



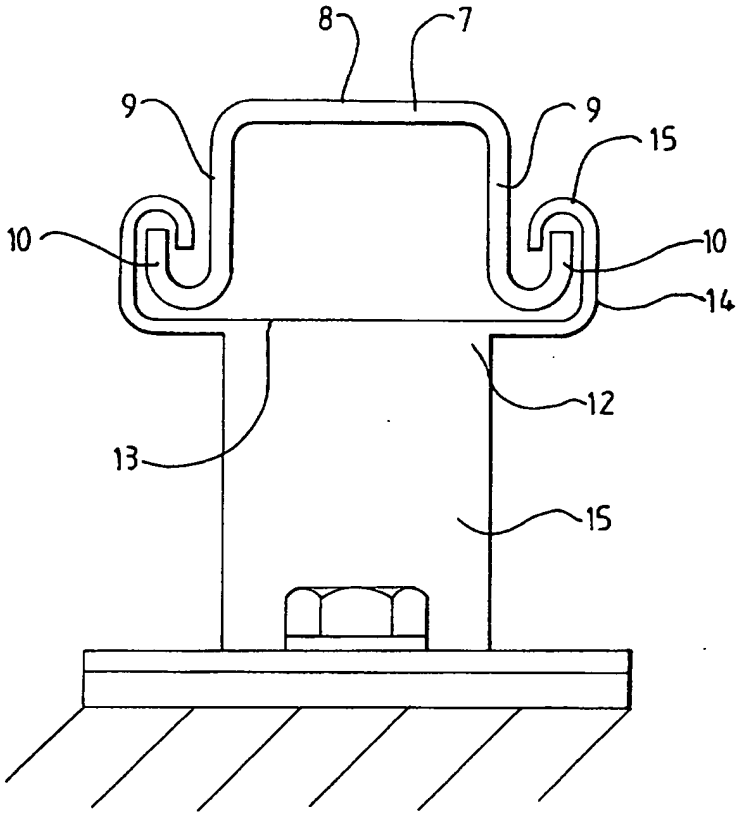


FIG 2

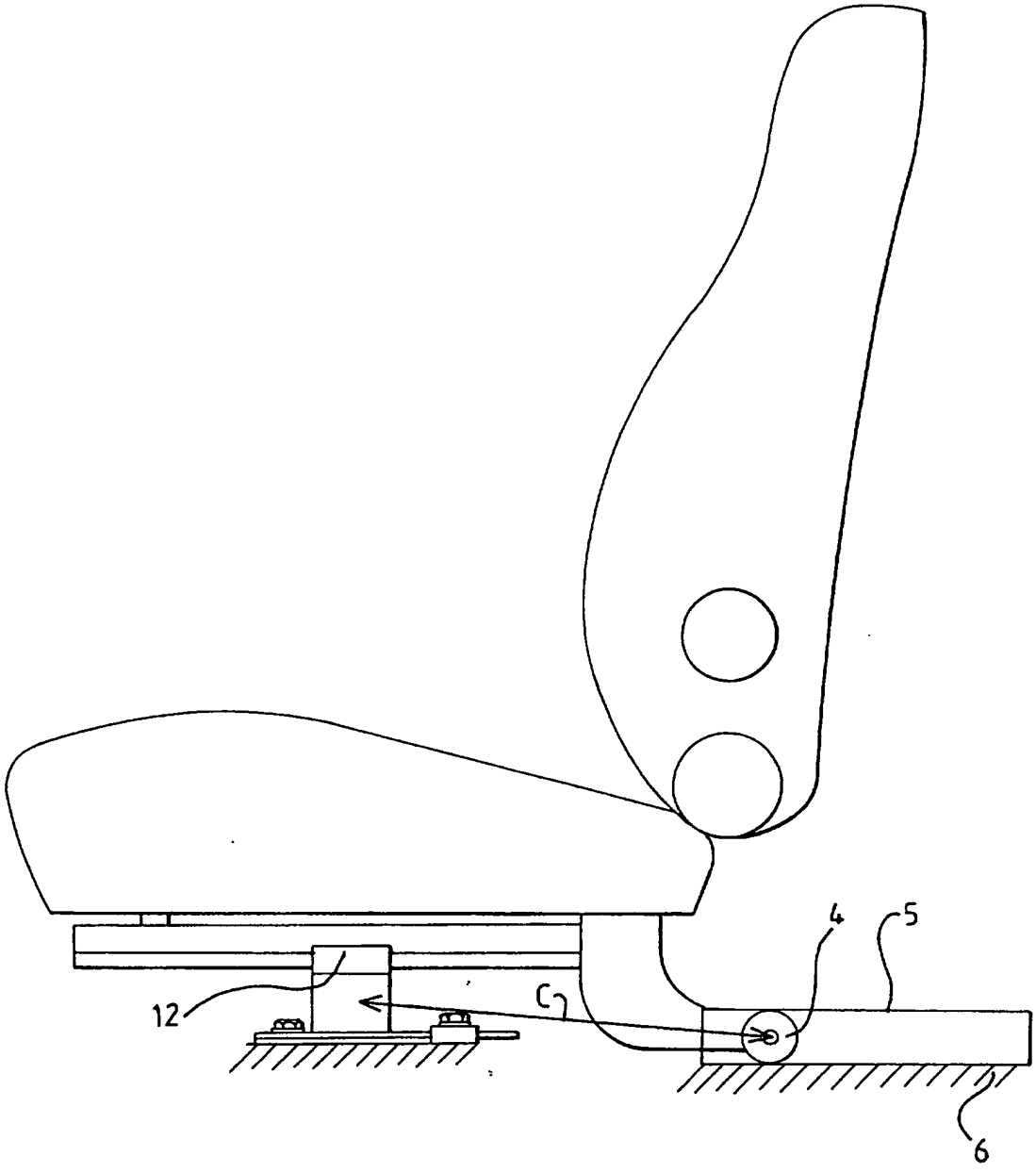


FIG 3

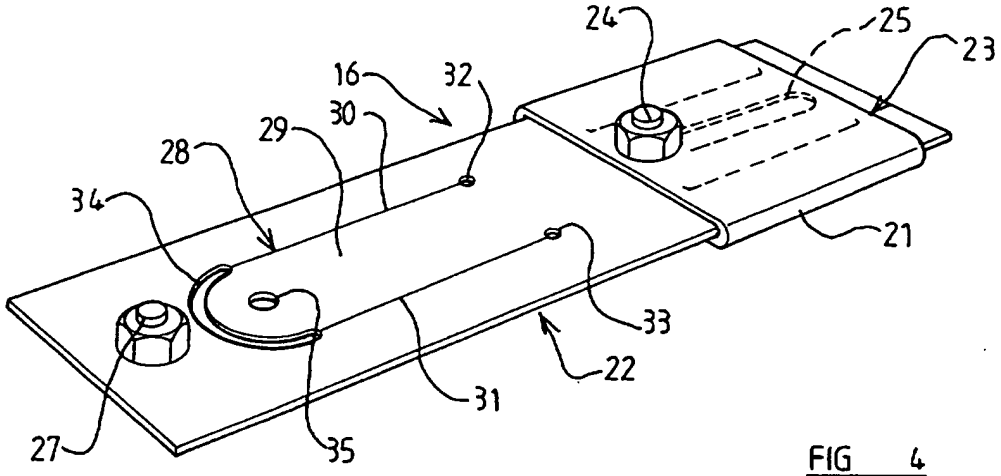

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FIG 4

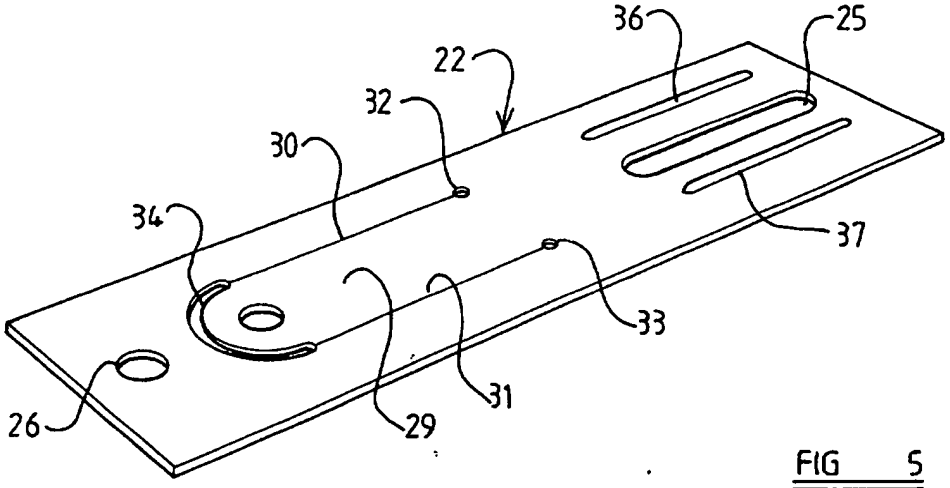
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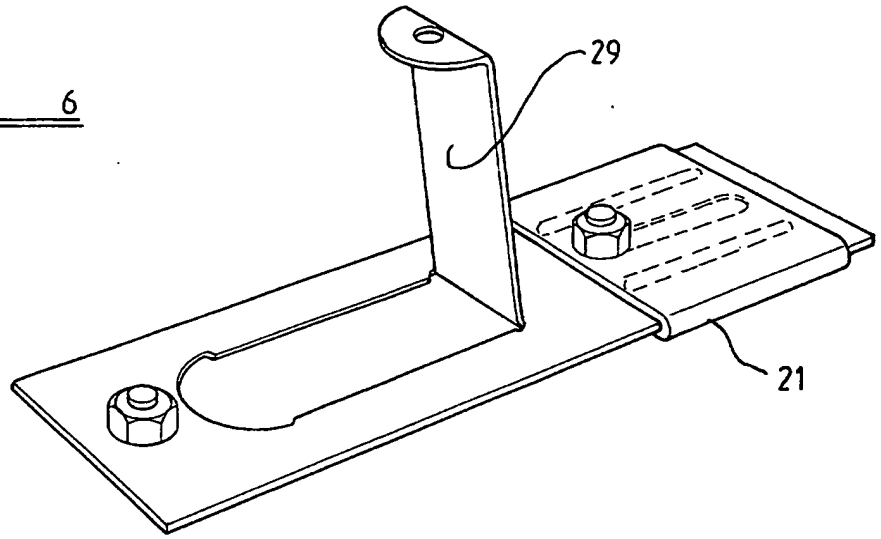
FIG 5

FIG 6



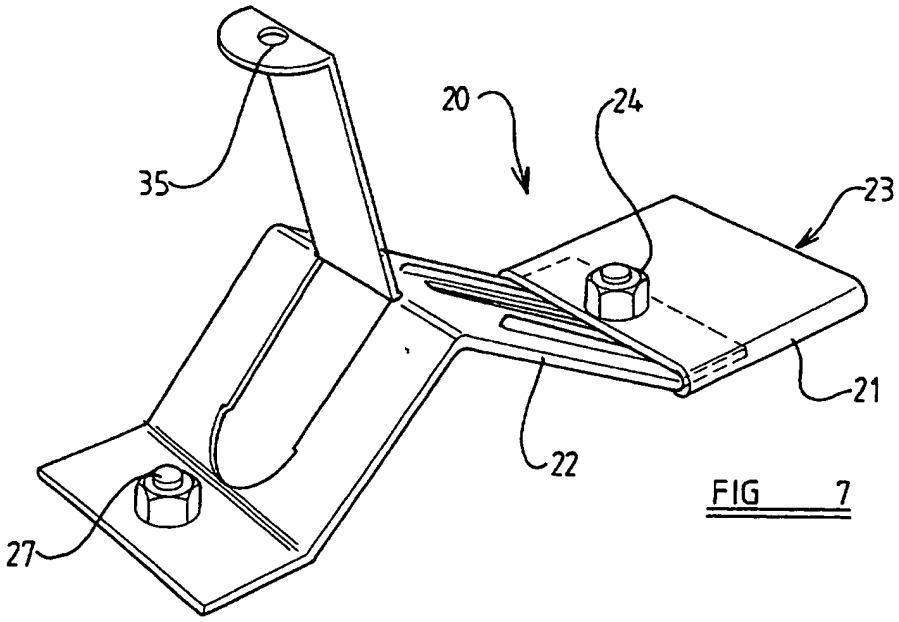


FIG 7

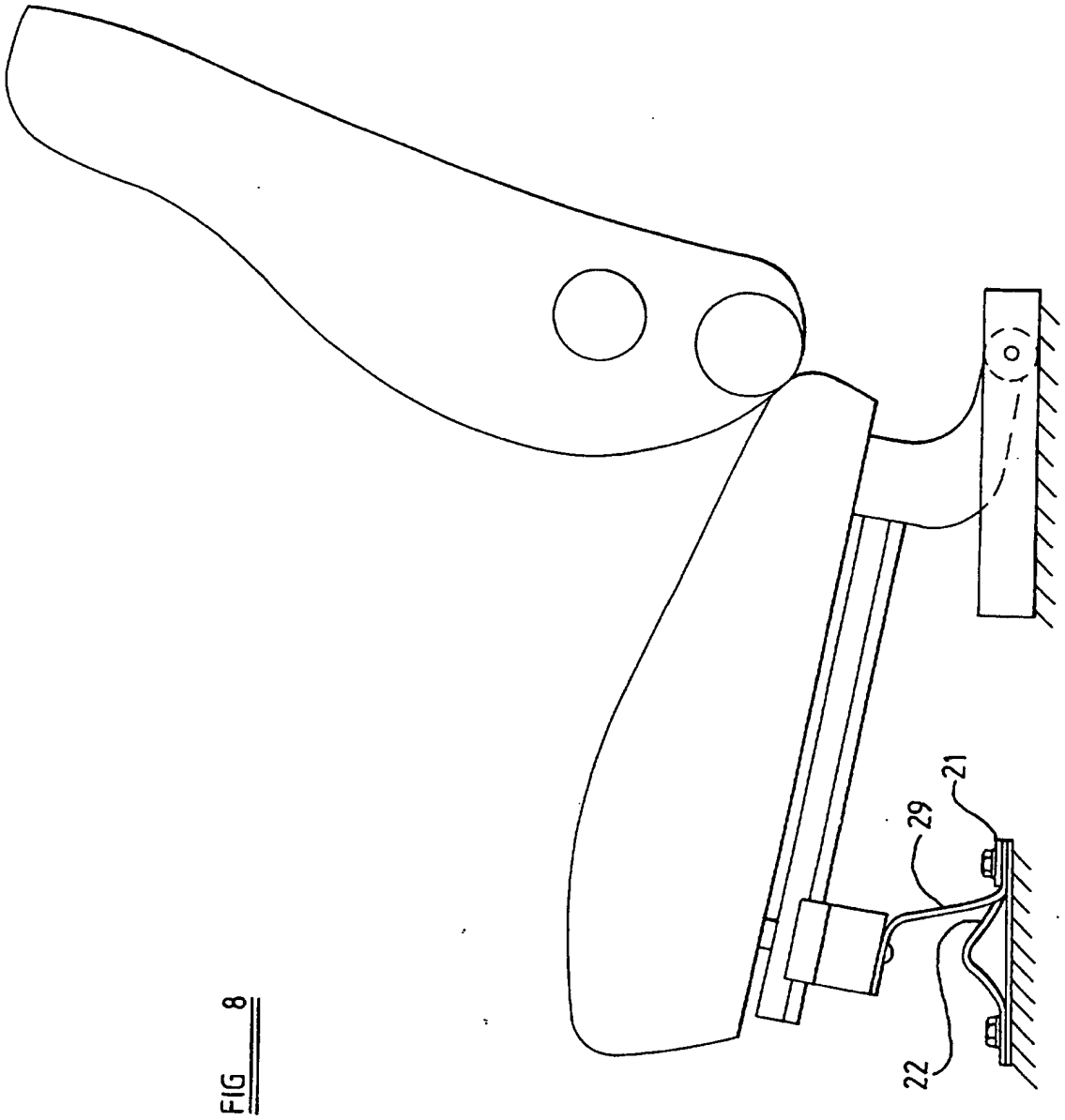


FIG 8

PATENTS ACT 1977

P14050GB-NF/jsd

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A VEHICLE SEAT"

THE PRESENT INVENTION relates to a vehicle seat, and more particularly relates to a vehicle seat for use in a motor vehicle such as a motor car.

It has been appreciated that if a motor vehicle, such as a motor car is involved in a rear-end collision, or rear impact, - that is to say if a following vehicle runs into the back of the car - the occupants of the struck car often suffer from neck injuries.

It is to be understood that during a rear-end collision of this type, the vehicle that is struck is subjected to a forward acceleration. This imparts forward acceleration to the seat of the vehicle. The squab and the back of each occupied seat engage the posterior and torso of the occupant of the seat and impart a substantial forward acceleration to the posterior and torso of the occupant. However, no corresponding acceleration is immediately imparted to the head of the occupant. The head is part of the body that has substantial mass, and consequently the head has substantial inertia.

Thus, whilst the posterior and torso of the occupant of the vehicle are accelerated forwardly as a result of the rear-end collision, the head of the

occupant of the vehicle initially remains stationary. This causes the neck initially to adopt a "S"-shaped configuration as the lower part of the neck moves forwardly, whilst remaining vertical, and the upper part of the neck remains in its initial position. Subsequently the head begins to rotate, and the neck then occupies a curved configuration. The head subsequently moves forwardly. Research has shown that "whip-lash" injuries may occur as the neck adopts the "S"-shaped configuration, if the head is moving relative to the torso at a substantial speed.

It has been proposed to provide an accessory for a vehicle seat which seeks to reduce the risk of whip-lash injuries occurring. GB-A-2,330,068 discloses an accessory which is utilised to connect each forward leg of a motor vehicle seat to the floor of the motor vehicle. In the event that a rear impact should occur, the torso of the occupant of the seat will apply a rearwardly directed force to the back of the seat tending to cause the seat to pivot rearwardly with a rearward "tipping" action, with that rearward pivotal movement being resisted, with a resistive force, provided by the accessory. The accessory comprises an elongate strip, one end of which is adapted to be secured to the shell of the vehicle, and the other end of which is retained and guided by a guide arrangement secured to the shell of the vehicle. An intermediate part of the strip is provided with a line of mechanical weakness defining a deformable tab. The tab is provided with a lug which is secured to the seat.

During an initial part of the rearward "tipping" movement of the seat, the accessory absorbs a first predetermined amount of energy as at least part of the line of mechanical weakness is torn and the tab is deformed from the strip. During a subsequent movement of the seat the accessory absorbs a second

predetermined amount of energy as part of the strip moves relative to the guiding arrangement.

An accessory of this type thus provides a two-stage predetermined resistive force, with the value of the resistive force at each stage being predetermined.

A seat in a motor vehicle may be occupied by people having different physical characteristics including relatively short, relatively light-weight children and relative tall, relatively heavy adult males. The force applied in a rear impact by the torso of the occupant of the seat to the back of the seat, tending to cause the seat to move pivotally rearwardly with a tipping motion is dependent upon the body weight of the occupant of the seat. If the accessory which provides the predetermined resistive force is selected so that the resistive force is appropriate for a relatively light occupant of the seat, the seat will not operate in the intended manner if the occupant of the seat is relatively heavy.

Thus the present invention seeks to provide an improved vehicle seat which may reduce the risk of whip-lash injuries.

According to one aspect of this invention there is provided a seat for mounting in a motor vehicle, the seat comprising a squab and a back-rest, the seat being provided with means adjacent the rear part of the squab to form a connection between the squab and the floor of a motor vehicle, the connection being such that the seat may effect a rearward pivotal tipping action about the connection, means being provided to resist said rearward tipping action with at least a first predetermined resistive force, the arrangement being such that the force resisting the rearward tipping motion is variable in dependence upon a physical characteristic of the occupant of the seat.

According to a second aspect of this invention there is provided a seat for mounting in a motor vehicle, the seat comprising a squab and a back-rest, the seat being provided with means adjacent the rear part of the squab to form an adjustable connection between the squab and the floor of a motor vehicle to permit a forward/rearward adjustment of the seat, the connection being such that the seat may effect a rearward pivotal tipping action about the connection, means being provided to resist said rearward tipping action with at least a first predetermined resistive force, the arrangement being such that the resistive force resisting the rearward pivotal action of the seat is dependent upon the forward/rearward adjustment of the seat.

Preferably the connection between the squab of the seat is a roller, the roller being received within a rail, the rail being adapted to be secured to the floor of a motor vehicle.

Conveniently the under-surface of the squab of the seat is provided with an elongate rail, the rail being slidably received within a shoe, the shoe being connected to an accessory constituting the means provided to resist said pivotal rearward tipping motion of the seat, the accessory being adapted to be secured to the floor of a motor vehicle.

In a preferred embodiment the means to resist the rearward tipping action are constituted by an accessory, the accessory being adapted to permit the rearward tipping action of the seat to which it is connected relative to the shell of a vehicle whilst absorbing energy, the accessory comprising an elongate strip, one end of which is adapted to be secured to the shell of the vehicle, and the other end of which is adapted to be retained and guided by means secured to the shell of the vehicle, an intermediate part of the strip being provided with a line of mechanical

weakness defining a deformable tab, the tab being provided with means to secure the tab to the seat, the accessory being adapted, during an initial movement of the seat, to absorb a predetermined amount of energy as at least part of the line of mechanical weakness is torn and the tab is deformed from the strip, and also being adapted, during a subsequent movement of the seat, to absorb a second predetermined amount of energy as part of the strip moves relative to the retaining and guiding means.

Preferably the second predetermined amount of energy is greater than the first predetermined amount of energy.

Conveniently the tab is defined by two substantially parallel lines of mechanical weakness and a substantially arcuate slot which inter-connects the adjacent ends of the lines of mechanical weakness.

In order that the invention may be more relatively understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a side view of a vehicle seat in accordance with the invention in a first position,

FIGURE 2 is a sectional view showing part of the seat of Figure 1, taken on the line II-II,

FIGURE 3 is a view corresponding to Figure 1 showing the seat in an alternate position,

FIGURE 4 is a view illustrating a force limiter forming part of the seat of Figures 1 to 3,

FIGURE 5 is a view illustrating part of the force limiter of Figure 4,

FIGURE 6 is a view illustrating the force limiter of Figure 4 in a second configuration,

FIGURE 7 is a view illustrating the force limiter of Figure 4 in a further configuration,

FIGURE 8 is a view illustrating the seat of Figures 1 to 3 in an alternate position.

Referring initially to Figure 1 of the accompanying drawings, a vehicle seat comprises a squab 1 to which is attached a back-rest 2. The seat is provided with rear legs 3, only one of which is shown. The rear leg 3 terminates with a roller 4 received within a horizontal rail 5 secured to the floor 6 of the vehicle, to enable a forward/rearward adjustment of the seat.

The underside of the squab 1 is provided with a rail 7. As can be seen in Figure 2, the rail 7 comprises an inverted "U"-shaped channel having a base 8, and opposed depending side walls 9, each side wall terminating with an outwardly and upwardly directed lip 10. The rail 7 passes through a shoe 12. The shoe 12 presents a horizontal support surface 13 which supports the rail 7. The surface 13 terminates, at each side, with an upwardly extending arm 14 which carries an inwardly curled finger 15, the fingers 15 embracing the free edges of the outwardly and upwardly directed lips 10 provided on the rail 7.

The shoe 12 is carried by a support block 15, and the support block 15 is connected to an energy-absorbing accessory 16 of the type disclosed in GB-A-2,330,068, which itself is connected to the floor of the vehicle.

The seat is shown in Figure 1 in a rearward-most position. The seat would occupy this position if the occupant of the seat is tall. In almost all cases a tall occupant is a heavy occupant. It is to be noted that with the seat in this position the distance L between the axis of the roller 4 and the accessory 16 is relatively long.

Figure 3 shows the seat of Figure 1 when the seat has been moved to a forward position. It is to be observed that the roller 4 has moved forwardly within the rail 5 fixed to the floor 6 of the vehicle. It is also to be noted that the rail 7 provided on the under-surface of the squab 1 of the seat has moved forwardly relative to the shoe 12. The rail 7 slides relatively freely through the shoe 12. It is to be noted that with the seat in this position the distance L between the axis of the roller 4 and the accessory 16 is relatively short.

Referring now to Figures 4 to 6, the energy-absorbing accessory 16 is illustrated. The accessory 16 comprises a housing 21 and a deformable strip 22.

The housing 21 forms a retaining and guiding element for the strip 22, and is in the form of a tubular housing defining a flat rectangular cross-sectioned passage 23 extending therethrough. A retaining bolt 24 is provided which extends transversely of the through-passage 23, the bolt 24 being aligned with the axis of the passage. The bolt 24 secures the housing 21 to the floor of the vehicle.

The strip 22 is a flat strip having a cross-section dimensioned to fit within the through-passage 23. One end of the strip extends through the passage 23 and is provided with an oval elongate slot 25 through which the bolt 24 passes.

The other end of the strip 22 is provided with an aperture 26 which receives a retaining bolt 27 to secure that end of the strip to the floor of the motor vehicle.

Intermediate the housing 21 and the retaining bolt 27 the strip 22 is provided with a substantially U-shaped line of mechanical weakness 28 which serves to define a tab 29. The line of mechanical weakness comprises two axially extending parallel sections 30,31 which commence at respective small apertures 32,33 formed on opposite sides of the axis of the strip. The parallel sections of the line of mechanical weakness are inter-connected, at a position remote from the apertures 32,33 and adjacent the bolt 27 by means of an arcuate slot 34 which is formed in the strip. At the centre of curvature of the arcuate slot 34, an aperture 35 is provided.

As can be seen most clearly in Figure 5, on either side of the oval elongate slot 25, the strip is provided with axially orientated upstanding projections 36,37. The size of the projections 36,37 is such that they form a friction fit within the through-passage 23 formed in the housing 21.

It is to be appreciated that, in use, the accessory is secured to the floor of the motor vehicle by means of the bolts 24 and 27. A bolt will be passed through the aperture 35 to connect the tab 29 to the lower part of the connecting block 15.

In the event that a rear impact should occur, the vehicle and the seat will move forwardly tending to impart a forward acceleration to the torso of an occupant of the seat. However, the torso of the occupant of the seat will apply a

rearwardly directed force to the back of the seat tending to cause the seat to rotate, in a clockwise direction with a rearward pivoting tilting action as shown in Figure 8 about the axis of the roller 4. During an initial movement of the seat, the parallel sections 30,31 of the line of mechanical weakness, and the tab 29 will be deformed, so that the tab 29 is moved to a position in which it extends upwardly above the rest of the strip. The tearing of the seating 30,31 line of mechanical weakness 28 is facilitated by the presence of the slot 34 and will terminate when the small apertures 32,33 are reached.

It is to be understood that this tearing of the material forming the strip, and the deformation of the strip absorbs a predetermined amount of energy, and thus provides a first resistive force.

The accessory will thus have the condition illustrated in Figure 6.

If, at the end of this particular stage in the operation of the device, the torso of the occupant of the seat is still applying a rearward force to the back of the seat, the tab 29 moves upwardly away from the housing 21. The portion of the strip 22 which is retained within the housing, thus emerges from the housing, with the elongate slot 25 moving forwardly relative to the bolt, as a second movement. This forward movement is effected against the frictional effect provided by the protrusions 36 and 37 which engage the interior of the through-passage 23. Also energy is absorbed by the resultant bending of the strip 22. The housing 21 serves to guide the strip during this movement, but the presence of the bolt 24 ensures that the strip is retained when a desired degree of movement has been effected, since the bolt will engage the end of the oval elongate slot 25 which is closest to the free end of the strip 22, thus preventing the strip from being withdrawn any further from the housing 21.

During this second movement of the strip, energy is absorbed frictionally by the engagement of the projections 36 and 37 with the interior of the housing 21, and also by the deformation of the strips. Thus during the second movement of the strip, a predetermined amount of energy is absorbed, and the accessory provides a second predetermined resistive force.

The accessory, at the end of a severe rear impact, presents the appearance shown in Figure 7 and Figure 8.

It is to be understood that in certain embodiments of the invention, the second movement in which the strip is withdrawn from the guiding and retaining means, may commence before the first movement, in which the line of weakness is torn, has been fully completed.

It is to be appreciated that in the described embodiment of the invention, the first resistive force, and the second resistive force, provided by the accessory 16 is applied to resist the rearward pivotal "tilting" motion of the seat at a distance L from the pivot axis of the pivoting motion of the seat, as constituted by the roller 4. The length of the distance L depends upon the position of the seat within the motor vehicle. The position of the seat within the motor vehicle will depend upon the height of the occupant of the seat. A relatively tall seat occupant will, virtually automatically, move the seat to a rearward position as shown in Figure 1, in which case the distance L is relatively large. A relatively small seat occupant, however, will move the seat to a forwardly adjusted position, as shown in Figure 3, in which the distance L is relatively shortly.

It is to be understood that the force that needs to be applied to the back of the seat 2 to cause the seat to pivot about the pivot axis defined by the roller 4 is the product of the resistive force provided by the accessory 16 and the distance L.

Thus the force required to achieve the pivotal tilting action when the seat is in the position illustrated in Figure 1 is much greater than the force required when the seat is in the position illustrated in Figure 3.

Thus it is to be understood that the force required to effect pivoting of the seat, (or, in other words, the force that actually opposes the rearward tipping pivotal action as provided by the accessory 16), varies in accordance with the height of the occupant of the seat. To a first approximation the height of the occupant of the seat is related closely to the weight of the occupant of the seat, and thus, in the described embodiments of the invention, the force that has to be overcome to effect the rearward tipping motion of the seat varies in accordance with the weight of the occupant of the seat. Thus the force is dependent on a physical characteristic of the occupant of the seat.

Thus a heavy seat occupant will, in the case that a rear impact occurs, experience a rearward pivotal tipping motion of the seat which is resisted by a very strong resisting force, whereas a light occupant of the seat will experience a pivotal rearward tipping of the seat which is resisted by a relatively low resisting force.

It is to be appreciated that in the described embodiment the accessory that provides the resistive force actually provides two levels or two stages of resistive force. Because the effective force that is experienced by the seat is the product of the force provided by the accessory and the distance between the accessory and the pivot point defined by the roller 4, in each position of the seat the seat will experience both levels of resistance provided by the accessory, at a magnitude determined by the position of the seat.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A seat for mounting in a motor vehicle, the seat comprising a squab and a back-rest, the seat being provided with means adjacent the rear part of the squab to form a connection between the squab and the floor of a motor vehicle, the connection being such that the seat may effect a rearward pivotal tipping action about the connection, means being provided to resist said rearward tipping action with at least a first predetermined resistive force, the arrangement being such that the force resisting the rearward tipping motion is variable in dependence upon a physical characteristic of the occupant of the seat.

2. A seat for mounting in a motor vehicle, the seat comprising a squab and a back-rest, the seat being provided with means adjacent the rear part of the squab to form an adjustable connection between the squab and the floor of a motor vehicle to permit a forward/rearward adjustment of the seat, the connection being such that the seat may effect a rearward pivotal tipping action about the connection, means being provided to resist said rearward tipping action with at least a first predetermined resistive force, the arrangement being such that the resistive force resisting the rearward pivotal action of the seat is dependent upon the forward/rearward adjustment of the seat.

3. A seat according to Claim 1 or Claim 2 wherein the connection between the squab of the seat is a roller, the roller being received within a rail, the rail being adapted to be secured to the floor of a motor vehicle.

4. A seat according to any one of the preceding Claims wherein the under-surface of the squab of the seat is provided with an elongate rail, the rail being

slidably received within a shoe, the shoe being connected to an accessory constituting the means provided a resistive force to resist said pivotal rearward tipping motion of the seat, the accessory being adapted to be secured to the floor of a motor vehicle.

5. A seat according to any one of the preceding Claims wherein the means to resist the rearward tipping action are constituted by an accessory, the accessory being adapted to permit the rearward tipping action of the seat to which it is connected relative to the shell of a vehicle whilst absorbing energy, the accessory comprising an elongate strip, one end of which is adapted to be secured to the shell of the vehicle, and the other end of which is adapted to be retained and guided by means secured to the shell of the vehicle, an intermediate part of the strip being provided with a line of mechanical weakness defining a deformable tab, the tab being provided with means to secure the tab to the seat, the accessory being adapted, during an initial movement of the seat, to absorb a predetermined amount of energy as at least part of the line of mechanical weakness is torn and the tab is deformed from the strip, and also being adapted, during a subsequent movement of the seat, to absorb a second predetermined amount of energy as part of the strip moves relative to the retaining and guiding means.

6. A seat according to Claim 5 wherein the second predetermined amount of energy is greater than the first predetermined amount of energy.

7. A seat according to Claim 5 or 6 wherein the tab is defined by two substantially parallel lines of mechanical weakness and a substantially arcuate slot which inter-connects the adjacent ends of the lines of mechanical weakness.

8. A vehicle seat substantially as herein described with reference to and as shown in the accompanying drawings.

9. Any novel feature or combination of features disclosed herein.

Application No: GB 0004189.7 16 **Examiner:** Chris Archer
Claims searched: 1-9 **Date of search:** 13 June 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): A4L (LBEQ, LBEP)

Int Cl (Ed.7): B60N (2/42, 2/427)

Other: ONLINE: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2330068 A	(AUTOLIV) see whole document	5-7
A	EP 0075067 A1	(ARA) see page 5 lines 15 to 19.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.